Cell Interactions on Engineered Surfaces

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An understanding of cell-cell interactions on a spatially varying pattern can facilitate the design of engineered tissues. Cell-cell interactions are often studied on homogeneous surfaces, yet in tissues, cells have heterogeneous surroundings. The goal of this project is to understand how cell-cell interactions depend on the heterogeneity of their surroundings.

We made a surface of heterogeneous stiffness out of polydimethylsiloxane (PDMS) using common soft lithography methods. The patterns were coated with fibronectin, an extra cellular matrix protein, and MDCK (Madin Darby canine kidney) cells were grown on the surface. We recorded time lapse images of cells and analyzed their movement. On the homogeneous surface the nearest neighbor distance stays constant in time. By contrast. on the heterogeneous surface the nearest neighbor distance fluctuates dramatically. Thus the heterogeneity of the substrate heavily influences cell-cell interactions. These results suggest that substrate stiffness can be used to control cell behavior on engineered surfaces.

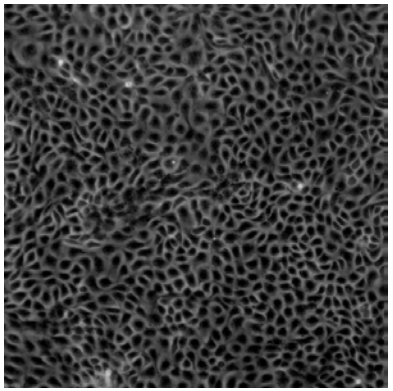

Fig. A: Homogeneous MDCK covered surface.

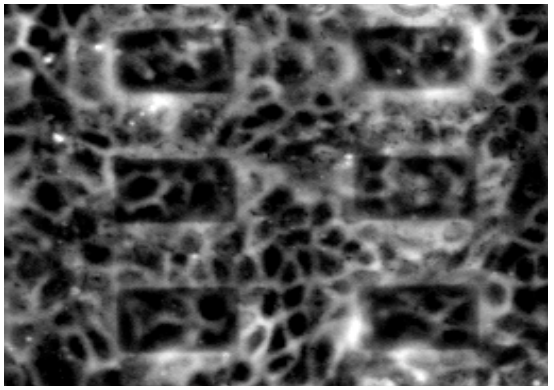

Fig. B: 90um x 60um stiff islands surrounded by soft continuum.

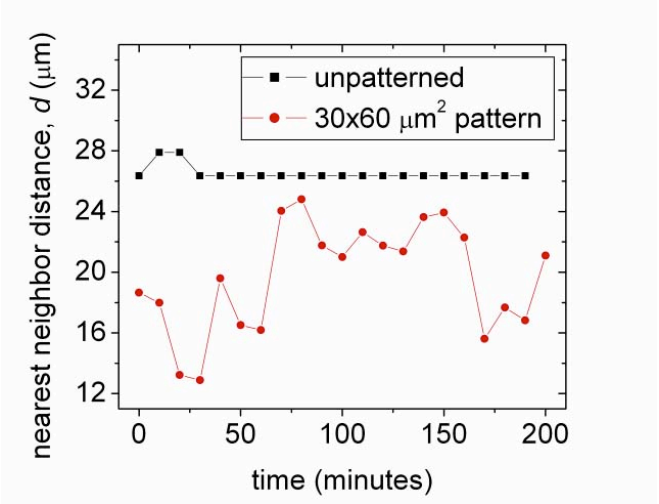

Fig. C: Nearest neighbor distance made from correlation function.

Supported by NSF DMR-0649199